McElroy (Z. C.)

THE BROMIDES;

THEIR

PHYSIOLOGICAL EFFECTS AND THERAPEUTIC USES.

BY

Z. C. McELROY, M. D.,

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Maudsley on the Mind.

The Physiology and Pathology of the Mind. By HENRY MAUDSLEY, M. D., Physician to the West London Hospital. 8vo, pp. xv–442 (tinted paper). . . . Cloth, $4.00

Dr. Maudsley's aim in the preparation of this volume has been to treat of mental phenomena from a physiological rather than, as has hitherto been the habit, from a metaphysical point of view, and in his history of the inductive method, as applied to the interrogation of the mind, he shows conclusively that self-consciousness—the favorite resort of the schoolmen—is inadequate, contradictory, and unreliable. No book of the present day, devoted to the study of the mind, has attracted more attention or caused more comment than this. It is one of those works which mark the beginning of a new era in the study of mental science, and at the same time it is conceded on all sides to be, in its practical portions, a most reliable guide for the diagnosis, description, and treatment of insanity.

"Dr. Maudsley has had the courage to undertake, and the skill to execute, what is, at least, in English, an original enterprise. This book is a manual of mental science in all its parts, embracing all that is known in the existing state of physiology. * * * Many and valuable books have been written by English physicians on insanity, idiocy, and all the forms of mental aberration. But derangement had always been treated as a distinct subject, and therefore empirically. That the phenomena of sound and unsound minds are not matters of distinct investigation, but inseparable parts of one and the same inquiry, seems a truism as soon as stated. But strange to say, they had always been pursued separately, and been in the hands of two distinct classes of investigators. The logicians and metaphysicians occasionally borrowed a stray fact from the abundant cases compiled by the medical authorities; but the physician on the other hand had no theoretical clew to his observations beyond a smattering of dogmatic psychology learned at college. To effect a reconciliation between the Psychology and the Pathology of the mind, or rather to construct a basis for both in a common science, is the aim of Dr. Maudsley's book."—*London Sat. Rev., May* 25, 186[illegible]

"The first chapter is devoted to the consideration of the causes of insanity. It would be well, we think, if this chapter were published in a separate form and scattered broadcast throughout the land. It is so full of sensible reflections and sound truths, that their wide dissemination could not but be of benefit to all thinking persons. In taking leave of Dr. Maudsley's volume, we desire again to express our gratification with the result of his labors, and to express the hope that he has not yet ceased his studies in the important field which he has selected. Our thanks are also due to the American publishers for the very handsome manner in which they have reprinted a work which is certain to do credit to a house already noted for its valuable publications."—*Quar. Journal of Psychological Medicine and Medical Jurisprudence.*

"Then follow chapters on the diagnosis, prognosis, and treatment of insanity, each characterized by the same bold and brilliant thought, the same charming style of composition, and the same sterling sense that we have found all through. We lay down the book with admiration, and we commend it most earnestly to our readers, as a work of extraordinary merit and originality—one of those productions that are evolved only occasionally in the lapse of years, and that serve to mark actual and very decided advances in knowledge and science."—*N. Y. Medical Journal. January*, 1868.

"This work of Dr. Maudsley's is unquestionably one of the ablest and most important, on the subjects of which it treats, that has ever appeared, and does infinite credit to his philosophical acumen and accurate observation. No one has more successfully exhibited the discordant results of metaphysical, physiological, and pathological studies of the mind, or demonstrated more satisfactorily the uselessness of an exclusive method, or the pressing need of combined action, and of a more philosophical mode of proceeding."—*Medical Record. Nov.* 15, 1867.

"In the recital of the causes of insanity, as found in peculiarities of civilization, of religion, sex, condition, and particularly in the engrossing pursuit of wealth, this calm scientific work has the solemnity of a hundred sermons; and after going down into this exploration of the mysteries of our being, we shall come up into active life again chastened, thoughtful, and feeling, perhaps, as we never felt before, how fearfully and wonderfully we are made."—*Evening Gazette.*

"Dr. Maudsley's treatise is a valuable work, and deserves the careful consideration of all who feel an interest, not only in general metaphysical facts, but in those manifestations which mark the boundaries between health and disease in the human mind."—*Providence (R. I.) Journal.*

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The methods by which the action and uses of therapeutic agents have been determined, pursued from the remotest antiquity, have not yielded results at all commensurate with the skill and labor bestowed upon them. They were in the beginning individual empirical experiences, and they remain so to the present hour. As facts, they are treasures most precious. But their reapplication, in the absence of any general principles explanatory of their relations to the living organism, still depends on memory and individual judgment. The human body has been most patiently, industriously, and minutely examined and studied, in health and disease, but no broad and comprehensive generalization, or basis of life, throwing light on all its processes, in both conditions, is taught, either in schools or literature. The stately systems of nosology which reigned over the medical mind so many centuries, still leave their impress on the nomenclature and philosophy of health and disease of the present. The classifications of therapeutic agents have undergone no change whatever to make them correspond with the advanced and changed condition of philosophy, pathology, and organic dynamics. The novitiate in medical science, when he approaches the study of special therapeutics, does so almost unavoidably impressed with the idea of the separate entity of disease, and the local operation of remedial agencies. All through medical literature this is more or less positively inculcated. The separate entity of disease necessarily includes the idea of its local character, and writers

[1] Valedictory Address, 1869.

on therapeutics teach, if they teach any thing, the local operation of remedial agents, and the causation of disease.

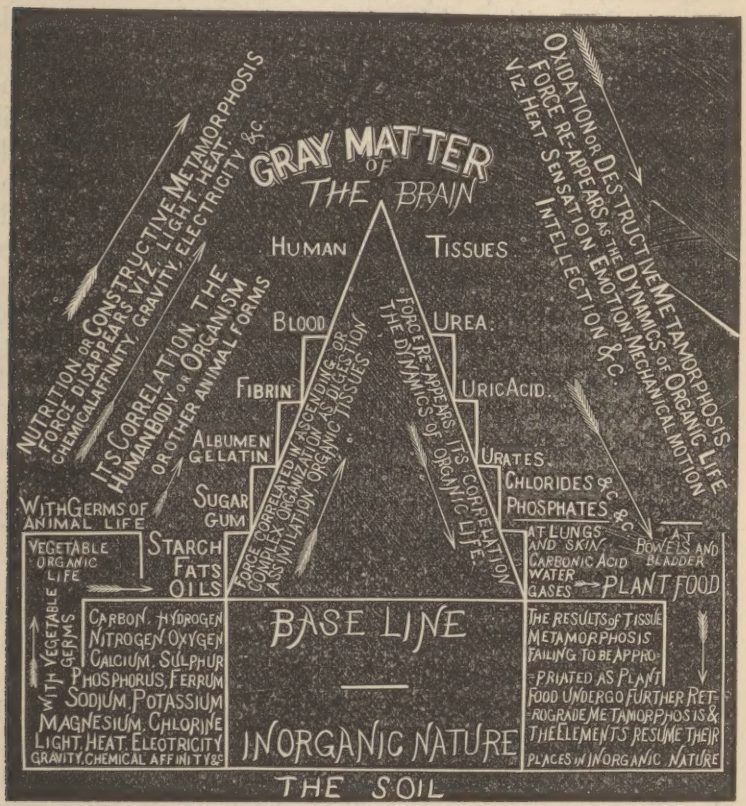
For these reasons, in this memoir on the "Bromides, their Physiological Effects and Therapeutic Uses," the beaten paths of the past will not be followed.

All of the processes of the living body will be reduced to the two generic totals of *nutrition and oxidation*, or *constructive and destructive metamorphosis*. Disease will be regarded as modifications of these two processes, and therefore generic and total; that is, at all times involving the whole organism. Therapeutic agents will, in like manner, be regarded, not as influencing a local part of the system, but these generic totals, by "promoting or retarding" them.

Negatively, it would seem that such a statement, as that all the processes of the living organism can be reduced to the two processes of constructive and destructive metamorphosis, would not need proof—would be self-evident. Yet, as taught in schools and literature, physiology and pathology do not do so. And, so long as the functions of the separate organs are studied with reference to their *secretions and excretions*, to the neglect of their positions in, and relation to, the living organism in its generic totals of nutrition and oxidation, the student of physiology will have his attention more or less diverted from the main purpose of physiology. No objection ought to be made to the study of the structure and purpose of the various organs, tissues, and textures, with all the aids from optics, chemistry, and comparative anatomy; nor to the study, chemically and microscopically, of their secretions and excretions—that is, the peculiar chemical condition of the organic matter which it is their apparent function to elaborate; but all these investigations should be subordinate to the leading one, of the relations they bear to the generic totals of ascending and descending metamorphosis.

The following diagram illustrates an ideal conception of these processes: For a base line, the condition of the elements in inorganic nature is taken. These elements are with a vegetable germ capable of forming—1. Vegetable organic compounds. 2. These, in turn, capable of assimilation, by the nutritive process, to the types and forms of animal organic

life. Then set up other lines to form a triangle, with well-defined ascending and descending steps. On the base-line to the left, arrange the elements, carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, calcium, soda, potassa, etc. Above



the base-line place vegetable organic life. On the steps of the ascending line, to the left, place the different foods, as they ascend in complexity, and this represents constructive metamorphosis. On the first, or lowest step, place fat, oil, starch, water, and oxygen. On the second, the next in complexity of organic compounds, as gum and sugar, etc. Third step, albumen, gelatine, etc. Fourth, fibrin. Fifth, blood. At the apex, human tissues. The brain, of all the tissues, having the highest complexity, and in virtue of its importance in the

dynamics of organic life, may very properly occupy the most elevated position in the diagram. On the right line, or descending line, representing destructive metamorphosis, may be arranged the results of tissue-metamorphosis, or the descending compounds, the temporary condition of organic matter on its return to the position of its elements in the inorganic world. That having the highest complexity, as urea, may occupy the highest step. On the succeeding steps place the results of retrograde metamorphosis, in the order of their complexity, until the base-line is reached. Above this place carbonic acid, water, and gases, and the other results of tissue-metamorphosis, constituting plant-food. Failing to be so appropriated, the compounds break up, and the elements take their places again in the inorganic world.

In these transformations, nothing has been added and nothing lost; but, between the points at which the elements leave and arrive again at their positions in the inorganic world, all the varied phenomena of plant, animal, and intellectual life have been manifested. In the ascending or constructive metamorphosis, force steadily disappears, and its correlant is the organization itself, until the highest point is reached in the gray matter of the brain. Coincident with decay, or destructive metamorphosis, force, and all its varied correlatives in the dynamics of organic life, reappear, giving rise to all the chemical, thermal, sensory, mechanical, emotional, and psychological phenomena of human life.

In affixing the position of the various organic instrumentalities in this strongly-marked outline of the generic totals of the human organism, some are found to perform only one office, as the alimentary tract and ductless glands—assimilation only. Others, as the kidneys, elimination only; while others, as the heart, capillaries, liver, and lungs, perform parts of both acts; the skin and lower bowels apparently performing, vicariously, one or the other office, but mainly that of elimination.

In its dynamic aspects, the cerebrum, cerebellum, medulla oblongata, and spinal cord, are to be regarded as the main or central power-producers; the ganglions and plexuses—the so-called sympathetic system—as supplemental to the central masses; as from their anatomical arrangement and known

physiological functions, each organ being supplied with a plexus, or ganglion, of magnitude corresponding with its importance, they are apparently intended to supplement, or isolate, and to some extent render each organ independent of the central power-producing masses in the distribution of dynamic capabilities: a very necessary arrangement, as otherwise accidental concussions, shocks, falls, etc., would more frequently prove fatal to life. While each organic instrumentality is a necessary fraction of the integer, or generic total, each organ has, to some extent, a separate and independent existence in virtue of these supplemental dynamic masses.

The nerve-cords proper are to be regarded as merely conveyers of sensation and dynamic force to and from the interior and exterior, and to and from all other parts of the organism; flashing, as it were, instantly, impressions and force all over the body.

In the past, and with a large proportion of my contemporaries, an *imaginary vital force* has been supposed to play a conspicuous part in organic life. The recent achievements of organic chemistry, and more exact views of the forces of organic and inorganic natures, have lifted the veil which has so long shrouded this so-called *vital force* in mystery. Organic chemistry now constructs, from inorganic elements directly, without the intervention of a germ, many of the less complex compounds of vegetable organization. Oils, fats, acetic and oxalic acids, have been thus constructed; but, though starch is almost within reach, it has never, as yet, been actually built up. The transformation of starch into glucose is an achievement common to manufacturers. Neither albumen, fibrin, nor organic tissue, has ever been made by organic chemistry, though the retrograde metamorphosis of animal tissue has been so controlled as to produce the same compound as its decay or destructive metamorphosis yields within the living body, as urea, uric acid, etc.

As formless organic matter, viz., oils, fats, etc., have been constructed from the elements directly, and as human tissues, composed of inorganic elements, are built up by the ordinary forces of inorganic nature, it is proposed to call this correlation of the physical forces the *formless force* or *organizing force*

of organic life. The only features of organic tissues unaccounted for by the operations of the ordinary physical forces of inorganic nature are their *forms*. It is proposed to call that force which gives and preserves the types and forms of organic life the *form-force* or *architect of organization*. Its only office is the giving and preserving form, with the momentarily changing material of animal life. And, apparently, this form-force is what has hitherto been regarded as the *vital*, for all else in animal life can be accounted for by the operations of the physical forces of inorganic nature. Instead of occupying the most important position in animal life, as heretofore supposed, in the construction of organic tissues, its position is subordinate to the ordinary physical forces, as evidenced by pathological anatomy: for, if the types and forms of organized tissues were always reproduced in full dynamic integrity and form, there could be neither disease nor death from disease—animal life would be perpetual. Pathological anatomy is an account of what occurs when the *form-force* (so-called vital) fails to preserve form, though tissue is still constructed by the *formless force* without the normal form. The *formless* or *organizing* force is the laborer, building up; the *form-force, the architect*, giving and preserving form. Over the *formless* or *organizing force* therapeutic agents have some control, but the *form-force* is beyond their influence. In therapeutical discussion it must, therefore, be left out entirely.

It seems even probable that the form-force is not peculiar to organic life, but is a correlation of the ordinary physical forces of the inorganic world. The forms assumed by inorganic matter, in passing from the liquid to solid states or forms, are too constant and definite not to be under the control of an invariable form-force. And it may hereafter be determined that the so-called vital or form-force of organic life is but the correlative of the form-force of the inorganic world. Loss of type, the organizing or formless force continuing in activity, tumors and other morbid growths, foreign in their structure and type to the human body, are produced, which, generally, are remediable only by their removal by surgical proceedings. As the inherent stability of some of them in organic nature is inferior to that of normal tissue, some therapeutic agents seem to pos-

sess the power to hasten the disintegration of some forms of them, even to the extent of their entire removal, among which the bromides and iodides are conspicuous.

A few more points in this physical basis of life remain to be considered, in completing the data for determining the physiological effects and therapeutic uses of any remedial agent. Among these are conceptions of the process of organic tissue-making, from formless organic compounds—histogeny; and the evolution of force.

Authorities for a few years past have generally conceded that solid tissue was constructed by means of minute cells, nourished by the highest organized constituents of the blood—fibrin. But the latest authority (Beale) is to the effect that it is by means of minute organic crystals, or granules, that the solids are formed. Not seeking to establish either of these minute points of histogeny in this memoir, the idea of crystals, or granules, is adopted, as more in accordance and harmony with the known phenomena elsewhere in Nature, of the formation of solids from fluids, and because few of the premises or conclusions of this essay rest on authority.

Time, mode, and velocity, are all important elements in the process of the formation of solid organized tissue from formless organic materials. The moment of time at which the conversion takes place is, perhaps, the most important in a therapeutical point of view; for it seems probable, if not certain, that it is then and there that most, if not all, therapeutic agents exercise their influence, for good or evil, in the living body. The negative of this proposition would seem to be, in itself, sufficient evidence of its correctness; for, so long as the process of nutrition, or the formation of tissue, proceeds normally, the result is health, not disease.

The mode has much also to do with the quality of the resulting solid tissue. The phenomena of continued fevers are, probably, conservative in this, that they are intended to remove defective tissue; or at least, in grave cases, most of the solid tissues of the body at the commencement of the morbid phenomena are wasted before convalescence is established. Many causes, however, contribute to produce defective solid tissue, among which extreme variations of temperature in

rapid succession are prominent. Velocity of formation has much to do, also, with the character of solid tissue. To decreased velocity of tissue-formation and loss of normal forms are due the phenomena and changes by which advancing life and old age are characterized.

As there is a time or moment at which formless fluid organic matter passes, through cells or granules, into solid organized tissue, so there is a time or a moment at which this solid tissue reassumes the fluid or gaseous form, or both, in its retrocession to lower states of organization. The agency by which this is certainly and mainly, though not, perhaps, wholly accomplished, is the oxygen introduced into the system at the lungs. Combining there with the organized hæmatin of the red disks of the blood, it is distributed to the regions of nutrition and oxidation, which are conceded to take place in the minutest capillaries of the blood-tubes. Of the results of these transformations, a portion is unfit for any other purpose in the system; the carbonic acid of the gaseous products finds exit at the lungs. Another portion, particularly of the alkalies, is arrested in the liver, where, after some not well-understood transformations, it is used to neutralize the acid of the chyme, as it arrives from the stomach in the duodenum; still another portion is arrested in the kidneys, further transformations take place, and, as organic salts dissolved in the water of the urine, pass out of the body through the bladder.

Over these processes, nutrition and waste, unquestionably therapeutic agents, do possess influence, modifying the mode and velocity of both processes.

These data would seem to establish that all therapeutic, hygienic, and remedial agencies, past, present, and future, can produce their effects only by promoting or retarding the generic totals of constructive and destructive metamorphosis, into which it is here proposed to arrange them.

As therapeutic agents apparently can only produce their effects by modifying the organic processes of repair and waste the causation of disease most likely acts in a similar manner; for, as has been stated, so long as these processes proceed normally, the result is health, not disease. In accordance with this conception, disease must consist in an altered condition

of the normal velocity and relations to each other of the processes of tissue-making and tissue-disintegration. Referring to the diagram, it will be seen that it represents the disappearance of force so long as organization is ascending, or acquiring complexity; or, in other words, it requires force to effect organization, the organization itself being in this instance the correlative of force. As neither matter nor force is susceptible of annihilation, and as force disappears as organization acquires complexity, so force reappears as complex organization is retroceding to simple states. Every form of force manifested by or in the living organism must then be coincident with some change of matter. All the chemical, mechanical, sensational, emotional, thermal, and psychological phenomena of the living organism are coincident with the decay or destructive metamorphosis of some of its various tissues.

Contrary to the implied teachings of medical literature, no pathological condition can be higher than normal life. Inflammation is spoken of as "high," which makes a pathological condition, in conception, higher than normal life. No error has been more mischievous in its effects on medical practice, and this from personal experience in the past. Inflammation of every possible grade essentially consists of oxidation, or destructive metamorphosis of tissue at higher than normal velocity, and its tendency is to death, not to a condition in the part affected more elevated than normal life; for, if it were, it should be hailed, not as a calamity, demanding the interference of medical skill, with therapeutic agents, but as a blessing for which all should be devoutly thankful.

What are called, in the present classification of therapeutic agents, "stimulants," as alcohol, opium, etc., are in reality "retarders of destructive metamorphosis." Thus, the reality embodies a conception directly the reverse of that commonly entertained. Those known as "sedatives," singularly enough, act in the same way precisely as stimulants, viz., by "retarding destructive metamorphosis;" the difference between the conditions pointed out as appropriate for their administration, in works on therapeutics, being the presence or absence of mechanical results, and these depending on the condition of the nerve-masses. If the waste is confined to the general tissues,

heat is the correlative, as indicated by the thermometer. If the nerve-masses are involved, there will be mechanical results in addition, as pain, spasms, convulsions, rapid and full circulation, etc.

The causation of disease must in some way primarily derange the normal relations of nutrition and oxidation as a totality, and before any local lesion can become apparent to our senses. There is not, and cannot be, such a thing as a local disease, with constructive and destructive metamorphosis proceeding elsewhere in the system normally. This is evidenced in many ways, as by change of temperature; and mechanical functions, as heart's action, loss of muscular power; loss of appetite, showing an arrest of nutrition; altered appearance of the surface, and expression of the face. Patients laboring under what is taught as a local disease, immediately lose the hue and color of health; the throes of the heart are more numerous than in health, or in some conditions less; the interior mucous surfaces undergo very great alterations, so far, at least, as vision can inspect them; the normal results of tissue-metamorphosis are no longer present in the excretions; the whole, not a part of the patient, is involved in the train of morbid phenomena.

With a sentient and ever-vigilant nervous system flashing impressions instantly all over the organism, such a thing as local disease, it would seem, is certainly impossible. A single aching tooth deranges the whole, not a part of the economy. A small abscess on the extremity of one of the fingers, or toes, involves the totals of nutrition and oxidation of the whole system. If disease or the effects of injuries were local, a crushed finger would not blanch the whole cutaneous surface, and incapacitate the sufferer from following usual occupations; nor would chloroform be needful to the surgeon in operations. Even moral impressions, very frequently, partially and temporarily arrest the whole train of life-phenomena, as in syncope, etc.

According to this physical basis of life, all therapeutic agents must necessarily be arranged as they are found by experience to influence the leading processes of repair and waste, which it is proposed to designate as follows:

Promoters and Retarders	
of Nutrition, or Constructive Metamorphosis.	of Oxidation, or Destructive Metamorphosis.

As each organized tissue has its own mode, time, and rate of nutrition and oxidation, these four leading classes may be subdivided just so many times as there are widely-different tissues to be influenced. For practical purposes this need not be very minute.

This classification satisfies all the requirements of exact science; and as, in chemistry, the nomenclature of compounds explains their chemical structure, so, in this classification of remedial agencies, the nomenclature itself conveys a definite conception of what each remedial agent does, and how it does it, in the living organism.[1]

As it lies outside the purposes of this memoir, on a single group of therapeutical agents, to arrange all remedial agencies in their appropriate places in the proposed classification, it is not here attempted, only so far as the special agents under consideration are concerned. They are "promoters of oxidation, or destructive metamorphosis." No difficulty will be encountered by any one familiar with existing knowledge in regard to what remedial agents actually accomplish, in the dynamics of organic life, in placing each therapeutic agent in its proper place. It does not suffice to be governed in deciding what are the effects of remedial agents, when stated by any of the existing names of classifications, as "stimulants," "alteratives," "emetics," "emmenagogues," etc., in works on general or special therapeutics, and current medical literature.

[1] The physical units of physiological animal bodies are, for the material, form; and for force, motion. For, to evolve any of the phenomena of an organized being, food must be converted by the process of nutrition, into form; and motion must occur in the molecular structure of the form. Over forms, the records of operative surgery demonstrate that therapeutic remedial, or hygienic agencies have no other influence, save in exceptional instances, than destruction. But over the physical unit of force, motion, the power or influence of remedial agents is very great. This classification is, therefore, critically and scientifically correct, as it includes the whole of the physical unit of motion.

The inquiry in reference to any special agent must be strictly limited to what it actually does, in determining to which of the classes it properly belongs.

The following general principles are applicable as aids:

1. The reign of law is supreme in the living organism.

2. For every dynamic result special instrumentalities are found. Without nerve-masses, no intellectual, sensory, emotional, or mechanical results are possible; without muscles no mechanical results can take place; without nerve-cords no transmission of impressions from one part to another, etc.

3. Every dynamic result, mechanical, thermal, sensory, chemical, emotional, intellectual, and psychological, is coincident with and depends on change of matter, and bears the relations of cause and effect, and in every instance oxidation.

In other words, and more general: for every dynamic result there must be change of matter, whether in organic or inorganic natures; either as gravity, fall of water, chemical affinity, as combustion or oxidation—change of temperature, heat being correlated in currents of air, or the evaporation of water.

4. That the human organism is an integer, composed of many fractions, and nothing can affect one part without affecting the whole. It is far more truthfully and emphatically "*E pluribus unum*" than its counterpart in the political world.

5. That as the totals of nutrition and oxidation are interfered with by the causation of disease, as well as all therapeutic agencies, the position of any remedial agent in the proposed classification is to be determined by its more prominent effects on either nutrition or oxidation: thus, the influence of alcohol is to retard destructive metamorphosis in a much greater degree than constructive metamorphosis; therefore, its proper place is with the "retarders of oxidation, or destructive metamorphosis."

6. The mineral acids, and the salts they form with many of the metals, as iron, zinc, bismuth, copper, etc., play more or less conspicuous parts in constructive metamorphosis. In other words, the acid elements predominate in nutrition.

7. The fixed alkalies, and the salts they form with min-

eral and organic acids, after the oxygen taken into the system of the lungs, are potential agents in the process of oxidation or destructive metamorphosis.

Gravitation, the continuity of matter, and persistence of force, are general principles underlying physical science. There must be some hitherto unrecognized principle of like character underlying the causation of disease, and the operation of remedial agencies. It seems most probable that it concerns their general or constitutional action, in contradistinction to their at present recognized local character, in all cases whatsoever. Reasons for rejecting the separate entity of diseased action, and the adoption of the opposite conclusion of its unity or constitutional character in every instance, have already been given. Equally strong reasons exist for regarding the *modus operandi* of therapeutic agents in like manner.

Mankind have in all ages of the world witnessed the rapidity with which the organic poison of serpents spreads over the system, inserted by their fangs beneath the cuticle. The quantity which it is possible for a serpent thus to inject must be very small indeed, yet it is sufficient in a very brief time, in many instances, to prove fatal to life. Nor is the serpent alone in this mode of defence or revenge. Bees, wasps, hornets, and many other species of animals, are so provided. The injection of any of them is local for, at best, so brief a time, as hardly to be measured. It now seems strange that the idea of using remedial agents by inserting them beneath the cutis never occurred to any one before our own times. The use of certain remedial agents by hypodermic injection is now sufficiently common in most civilized countries as no longer to be regarded as a novelty, though its origin hardly dates back a decade of years. Certain agents introduced subcutaneously extend their influence over the system almost, if not quite, instantly. If disease and remedial agents were local in their operation, medicine would have been an exact science centuries since. The action of other agents by the lungs, as anæsthetics, by the mouth, as prussic acid, or cyanide of potassium, affects the general system with nearly equal promptness as by the hypodermic syringe. The recent proposal of Prof. Broadbent, of London, to treat cancerous and

other morbid growths by the hypodermic injection of acetic acid, was unsuccessful only because the action of acetic acid could not be confined to the part injected. If there exists a single substance in Nature which does not affect the totals of nutrition and oxidation in the human body, it can serve no useful end as a therapeutic agent. For these, among many other reasons, it is impossible for me to regard either as local; and it further appears probable that these are the principles destined to educe order and certainty out of the existing uncertainty and confusion in practical therapeutics.

The relations between the living organism to be influenced, and therapeutic agents by which to influence it, are necessarily intimate and important. Without some definite understanding on these points, between author and reader, it would be impossible for the latter to judge conclusions properly. Each of the two factors has certain inherent properties, and relations to each other, retained through all mutations, and governed by fixed and unchangeable laws. Were it not so, the considerable space occupied in this memoir in considering the anatomy, physiology, pathology, and dynamics of the human body, would be out of place and unnecessary. It was seemingly demanded, because the physical basis of life, from which the physiological effects and therapeutical uses of the bromides are, in part, to be determined, is by no means generally recognized or accepted by the medical mind. The conclusions are, to a great extent, unsupported by "authority." The tendency of the medical mind is certainly in this direction, but not as yet recognized in schools or standard medical literature. But, that the physical body of man, over which alone therapeutic agents can exercise control, is composed of ordinary matter, whose elements are well known, and the equally well-known ordinary modes of the physical forces of the inorganic world, light, heat, electricity, magnetism, gravity, chemical affinity, etc., is certainly true. The sole fact unaccounted for is the forms of organic tissues and textures. The varied mechanical, thermal, chemical, sensory, emotional, intellectual, and psychological results are due to the varied organic instrumentalities, through and by which they are manifested.

The apparently summary dismissal of the so-called vital force from the domain of therapeutics is certainly warranted by the data here brought forward; and no fact or circumstance bearing on it has been purposely left out or avoided. The desire as well as design has been, from the beginning, to face squarely the whole problem, and to arrive at conclusions warranted only by all known facts, and indifferent as to what they should be, only that they should represent the truth.

Bromine is an elementary substance, sparingly diffused through Nature, having been found only in sea and mineral waters, and certain marine productions; and is a discovery of our own times (1826). In its pure state, it is highly caustic, and exceedingly obnoxious to all animal organic life. It is quite volatile, boiling at 117° F., and becoming solid at 4° below zero. It is analogous in many respects to iodine, with many points of resemblance to chlorine. It forms, like iodine and chlorine, acids with both hydrogen and oxygen, and combines directly with metals, and forms salts with the fixed alkalies and ammonia.

Bromides of potassium, sodium, ammonia, iron, and mercury, have been experimented with as therapeutic agents. But the preparation enjoying the most favor with physicians, and consequently most largely used, is the bromide of potassium. A concentrated solution of bromine is used as a caustic.

As the modes of preparing these different salts and bromine in solution, their sensible properties, etc., are accessible in elementary works, it is not deemed necessary here to reproduce them.

What are the physiological effects of the bromide of potassium? According to the data and classification of therapeutic agents here submitted, it is a "promoter of destructive metamorphosis." Its place is there theoretically, and the empirical results following its administration sustain the inference. It is composed of two elementary substances, bromine and potassium, both of which are, in their uncombined state, active potential caustics—that is, agents to break down organization.

It is not at all probable that it maintains its chemical character in the midst of the incessant molecular changes which constitute organic life. The elements cannot, by any new

combinations they may form, change their inherent relations in that respect; and so must continue to increase the velocity of the retrograde metamorphosis of the tissues, and the oxidation and expulsion of effete matter. This view is fully sustained by careful analysis of the excretions during its administration. Though a very small portion finds exit at the kidneys unchanged, the greater part is excreted, wholly changed in chemical character. The part played by potassium in any of its manifold chemical combinations, in organic life, is very uniformly that of "promoting destructive metamorphosis," of muscular tissue more particularly. Soda, on the contrary, performs an important function of a somewhat different character, as, in combination with phosphoric acid—basic phosphoric acid—it combines with and conveys carbonic acid from the capillaries to the lungs, where it is liberated and finds exit from the body. While there is little or no increase of thirst for water, from even large doses of bromide of potassium, it is exactly the reverse with bromide of sodium—in that respect resembling chloride of sodium—and the amount of chlorides is remarkably increased by both in the urine, as well as the total quantity of urine, and most other results of tissue-metamorphosis except urea—the system tolerating the presence of the bromide of potassium, but expelling, with all possible haste, that of sodium. For some of the above facts credit is due to Surgeon J. H. Bill, U. S. A., who published a paper in *The American Journal of Medical Sciences* for July, 1868, containing the results of a series of experiments on his own person with bromide of potassium particularly, and incidentally with bromide of sodium, with a view to determining the anæsthetic and hypnotic properties alleged to be possessed by the former. The conclusions, mainly in his own language, are as follows: Variation of temperature, not worth recording; acidity of urine increased; chlorides excreted always notably increased; potassa excreted largely increased; bromides in urine hardly detectable; quantity of urine always increased, but without thirst; quantity of urea not affected; uric acid increased; carbonic acid decidedly increased; fæces diminished in weight. No totals are given, nor can any be deduced from his tables; but the enumeration of rational symp-

toms under large or toxic doses of bromide of potassium is as follows: Drowsiness; albumen; suffocative feeling; drowsiness, relieved by open air; albumen in marked quantity; great discomfort and restlessness; albumen present; fitful sleep; drowsiness and suffocative feeling; felt ill; great lassitude; albumen in large amount.

Surgeon Bill also instituted another series of experiments, with morphia and cannabis indica, showing results exactly opposite to those with the bromide of potassium—large decrease in the excreta, and the results of tissue-metamorphosis contained in them. The testimony of all his experiments is in favor of the classification of therapeutic agents proposed in this memoir.

Surgeon Bill's results confirm the safety of deducing the physiological effects from the inherent relations of the bromides to organic life; and empirical therapeutics still further confirm their correctness.

Physiologically and therapeutically, all the bromides (potassium, sodium, ammonia, iron, and mercury) are agents to promote waste—tissue-metamorphosis—and differ from each other only in the extent of their interference with nutrition, and their activity in promoting waste; the bromide of ammonia being the least active, and that of mercury most so. Their effects are more noticeable on abnormal tissue, or tissue of a type foreign to the human body, as enlarged glands, scrofula, cutaneous eruptions, syphilitic and others; and organic matter interstitially deposited in the tissues, below the normal dynamic grade of life. This latter condition is induced by the interference of some foreign substance with nutrition and waste, not immediately active, as in lead-colic and paralysis; or by deficient physical exercise in those of sedentary habits; or vicissitudes of temperature, as in intermittent fever; and many other causes.

An exaggerated illustration of the "nervous states," depending on the retention of effete matter in the system, is had in retention of urine. Even when it is only moderate, the typically "nervous condition" is most striking. An evacuation of the bladder by the catheter is followed by the most delightful tranquillity, drowsiness and sleep, with no secondary

effects as drawbacks. To attribute to the catheter "anæsthetic properties," or "hypnotic effects," would only be true from a certain narrow point of view. Yet, on the surface, there are cause and effect very closely connected.

Another illustration of the "nervous condition" is seen in the so-called lead-poisoning, or "lead-colic." The general *malaise* and suffering are here known to depend on the presence of lead interstitially deposited in the tissues in an unknown chemical condition. Temporary relief may be and is obtained by opium, belladonna, chloroform, etc., which act by retarding destructive metamorphosis in the nerve-masses more particularly than elsewhere; permanent relief only when the lead, and the tissue it has rendered unfit for the purposes of life, are removed by destructive metamorphosis, under the existing nomenclature "absorption." If this could be accomplished as promptly as the removal of the retained contents of the bladder by the catheter, the same results would follow as speedily; delightful tranquillity, drowsiness, and sleep, would soon follow; but no agent has been found to do it, and in all probability never will.

By the aid of these extremes, the whole range of neuroses, not depending on structural changes, involving loss of form,[1] may, by analogy, be explained; and the explanations would most likely be correct, because empirical therapeutics prove them so.

An unknown something gives rise to a neuralgia—pain in a certain local part—the whole organism is involved, however, as evidenced by the pain, general nervousness, inability to sleep, etc. Opium, in a certain way, procures present relief. Unaided molecular activity may then bring permanent relief by removing the cause. But failing, and it often does, the bromides, by promoting molecular activity, remove the cause, and permanent relief is obtained in a different way. Such are, apparently, the facts in the so-called neuroses. But the bromides are by no means the only remedial agents for such conditions. The rough but sanitary effects of emeto-cathartics, as well as those of mercurials, salines, natural mineral-waters,

[1] Lost form is one of the physical units of pathology.

violent exercise, etc., are all in more or less use, and with a large measure of success.

Therapeutically, the bromides are never indicated except when there is something to be wasted. The abnormal tissue of an enlarged gland in scrofula is never changed to natural tissue. All that is abnormal must be wasted to give place to natural tissue, to be constructed in its stead. So of cutaneous tissue, with loss of type or form, constituting skin-diseases. No therapeutic agent can change it to its natural type. Some of them, as the bromides, may, and do, promote their waste. If normal tissue is constructed in its place, then there is recovery, but not otherwise. And the failure of the form-force to reproduce it in normal type is the reason why cutaneous diseases are an opprobrium of medical art and skill. No therapeutic measures that "cure" a case of chronic cutaneous disease, or enlarged glands, do so otherwise than by wasting the abnormal tissue. Syphilitic diseases are generally more successfully treated by agents that promote waste than those which promote repair; and these, separately, not unfrequently fail. But by combining "promoters of constructive and destructive metamorphosis," as in the bromide or iodide of iron, or quinia, better results frequently follow; always provided organic material is supplied with which to carry on the reconstructive processes. Not unfrequently, however, recovery can only be had by withholding entirely all wasting measures whatever, and in their stead using every possible means to "promote constructive metamorphosis," the inherent forces of the organism suffice for the substitution of normal for abnormal tissue, with complete recovery as the result. This is more likely to occur, however, when the full normal velocity of tissue-metamorphosis is maintained by physical exercise, or other favorable conditions, as by introducing extra quantities of oxygen into the system by what is called "superoxygenation," and perhaps other means, but none are so certain as hard labor in the open air and sunshine.

The following cases may serve to illustrate these general principles as applied in actual practice:

February, 1866, Mrs. ——, aged thirty-six; four children; weight 160 lbs.; well fed, clothed, and provided for, was seized

with severe pain in the right groin, over the region of the ovary, tongue furred, appetite capricious, excited circulation, and general febrile condition. Had distinctly marked daily exacerbations of fever, which did not yield to quinia. Considering the case to be one of typho-malarial fever, she was put on salines, and a general sustaining course of management; having to resort frequently to anodynes by the mouth, and hypodermic syringe, to relieve the pain in the groin. This condition of things continued about three weeks, when partial convalescence was established; but with little or no relief from the pain in the groin. Patient would not permit blisters or cups to her groin, so had to use ointments and liniments. No satisfactory results were obtained, and a careful investigation of the case was again made, resulting in finding no lesion of the uterus or vagina; but the ovary on the painful side was certainly somewhat enlarged and tender. The temperature, circulation, and respiration, were nearly natural, and patient was in good flesh; and as on some days she escaped from pain altogether, the diagnosis fixed the origin of her suffering in the ovary. She now submitted to be leeched, and then cupped, and had one blister in the groin, with mercurial ointment and belladonna pretty constantly rubbed about the seat of pain. But still she did not get well, and had to use a good deal of opium to keep at all comfortable. At this stage of the case, from some reports in journals, about that time, of apparently similar cases being relieved by the bromide of potassium, she was put upon it, half a drachm daily, gradually increased to a drachm daily. It was commenced soon after a change, and continued until the next monthly period, she losing flesh all the time. This change was the most painful one she had ever had, and, as usual at such times, all treatment was discontinued but opium. When her change was over, it was evident she was very much worse, and a trip to the sea-shore was planned and carried into effect immediately. At the sea-shore she rapidly got worse, and at the end of a month returned home thoroughly disheartened, with the conviction deepening on her mind that she was going to die. Another investigation of her case, with counsel, was made, and previous diagnosis only modified by her wasted condition. Iron, zinc, bismuth, and

good living, were prescribed, followed by rapid improvement in her general health. Her side and back were cupped occasionally, and she gradually became better in every respect, and has been able to attend to her ordinary duties, with only occasional returns of pain for a year past.

In this case, the rapid wasting of the patient under the use of the bromide of potassium was very striking. On her removal to the sea-shore, under saline influences still, the wasting made equally rapid progress. It appeared, at the time of her return, as if she would certainly die, unless the tide of her life was speedily turned.

Per contra. Having struggled through to light against all "authority" in therapeutics, the following case was treated:

Mrs. P., aged sixty, large, fleshy, well cared for, with a pulse too slow, though temperature and respiration nearly natural. Flesh a muddy, whitish, waxy appearance; has suffered with pains in the chest and stomach for some three years past. Is attacked more frequently in the night than in the day, but is liable to suffer at any time. Has thought from the beginning that there was something growing in her. Has had the services of many physicians, but received, from the opiates generally prescribed by them, only the most temporary relief. About a year since she went East for treatment, and during six months had the services of a popular physician in the city of Philadelphia, with about the same results as at home. Completely disheartened and discouraged, she returned, having made up her mind that she had a cancer, or some other mortal disease, and there was no relief for her. In this situation she came under my professional care. Diagnosticating in her case the retention of effete matter, interstitially deposited in her tissues, with a rate of tissue-metamorphosis altogether too slow, but without organic lesion, or loss of form, in any of her tissues, she was put on bromide of potassium, an ounce to a pint of water, tablespoonful in a tumbler of water three times a day. Simultaneously, she was to take citrate of iron in quinia, with saline laxatives. To have good, substantial diet, all her appetite would take. The hypodermic syringe was used a number of times, with solutions of morphia, and morphia and atropia to procure sleep.

She also had poultices of flaxseed-meal, with small portions of mustard to epigastrium and spine applied a good many nights. Subsequently quinia and belladonna, alternated with citrate of iron and quinia, were given, and a natural saline mineral-water substituted for the bromide. Persevering with the definite purpose in my mind of obtaining a higher velocity of tissue-change, and the wasting of present tissue, in the face of some discouragements, at the end of two months, she was fairly convalescent, and further treatment discontinued. A partial relapse took place in early winter, incident perhaps to her confinement indoors by unfavorable weather. Salines, with quinia, iron, and belladonna, soon reinstated her in her previous comfortable condition, which she continues to enjoy to the present time, having been seen within a week of this writing (February, 1870).

Miss B., June, 1868, very stout and fleshy, aged forty-four, takes but little exercise out of doors; suffers from shortness of breath, and her breath excessively fetid, and not owing to necrosed teeth; pains in her bowels and breast, with frequent vomiting soon after meals; is a very dainty eater, and is exceedingly "nervous." Rest at night very much broken; temperature andrespiration barely natural; pulse below the natural frequency. In her case the following diagnosis was made: All her organic processes are performed too slow; food does not go into tissue fast enough, and tissue waste much too slow; and her system, as a result, is loaded down with effete matter; but no organic changes, or loss of form in any of her tissues. She is literally "stuffed up."

Prescription: Bromide potassium, commence with half drachm, and gradually increase to a drachm daily, in large dilution, with occasional saline laxatives to carry off *débris* of tissue-metamorphosis. At the end of six weeks was very much better; color, appetite, and general appearance, better; has lost flesh, and sleeps much better. Is requested to walk more in the open air, and to discontinue medicine.

In concentrated solution, Dr. Goldsmith, U. S. Volunteers, first used bromine, with, perhaps, better results, in the gangrenous condition of wounds incident to hospitals, than any other single agent. In such conditions there are often deep

burrowings along the fascia of muscles, and course of tendons, and in the cellular tissue leading from the external opening. Some of the results of what is called gangrenous action are, under such circumstances, entirely absorbed, probably in the form of cells of very low organization, which multiply in the system with great rapidity, appropriating to their use the very slender supply of nourishment which it is possible to introduce in such circumstances, completely arresting nutrition, and tending with great rapidity to death. In the application of the bromine, every sinus must be laid open, and all clearly dead tissue or tissue of lost form removed by knife or scissors, and the wound cleansed as far as possible. Charpie or oakum, or, in the absence of both, cotton, saturated with the concentrated solution of bromine, with the aid of wooden instruments is pressed into every recess, in such way as to come into contact with every part of the diseased surface. The wound is to be filled up level with surrounding parts, and a bandage applied over all. No metallic appliances, or instruments, can be used in its application, and great care should be taken that the fumes, so rapidly disengaged, should be carried away from patient and assistants, as they are extremely irritating to the lungs; watches, chains, rings, pins, studs, pocket-knives, and every metallic article, should be laid aside before using the bromine for these purposes. Owing to these disadvantages, it will not likely be used except in grave cases, and only then after other and less unpleasant measures have failed. Its value, under these circumstances, is due entirely to its capacity of destroying every vestige of tissue below the grade of normal life in the part, with perhaps some absorption and more or less rapid oxidation of the foreign matter in the blood.

From this physiological, pathological, and dynamic survey of the human organism, on a physical basis of life, and the inherent relations of certain classes of therapeutic agents to its organic processes and structures, and from the physiological effects and clinical uses of bromine and the bromides, the following general conclusions are deduced:

1. That, from the inherent relations of bromine, and the bromides, to the organic tissues and structures of the human body, their physiological and therapeutical effects must always

be that of promoting destructive metamorphosis, or waste: first, of all matter below the normal dynamic condition; second, of tissue or structure of type or form foreign to the human body; and, lastly, of the normal tissues themselves.

2. That they are never indicated, therapeutically, except when there is matter or tissue in the body, which it is desirable to eliminate from it.

3. That they possess neither inherited nor acquired anæsthetic properties, nor hypnotic effects, as chloroform, ether, opium, or cannabis indica, which act by retarding destructive metamorphosis; but may, by promoting destructive metamorphosis of retained effete matter, be followed indirectly by anæsthetic or hypnotic effects, in the same way as the evacuation of the bladder of retained urine by the catheter.

4. That they are contraindicated where nutrition is much impaired, or the rate of tissue-waste more than natural, and where structural changes, or loss of form, by substituting tissue of lower for that of higher organization, have impaired the dynamic integrity of the nerve-masses, as in locomotor ataxy, insanity, spinal paresis, etc.

5. That they are only indicated where the organic processes of life are restrained or interfered with, by adventitious circumstances, to resume their normal working on the removal of the restraint.

6. That their effects on persons living luxuriously, and leading inactive or sedentary lives, and on all in whom tissue-metamorphosis is sluggishly performed, is to increase the rate of waste, and to compensate, to some extent, for the physical exercise necessary to maintain the normal velocity of tissue-waste or changes.